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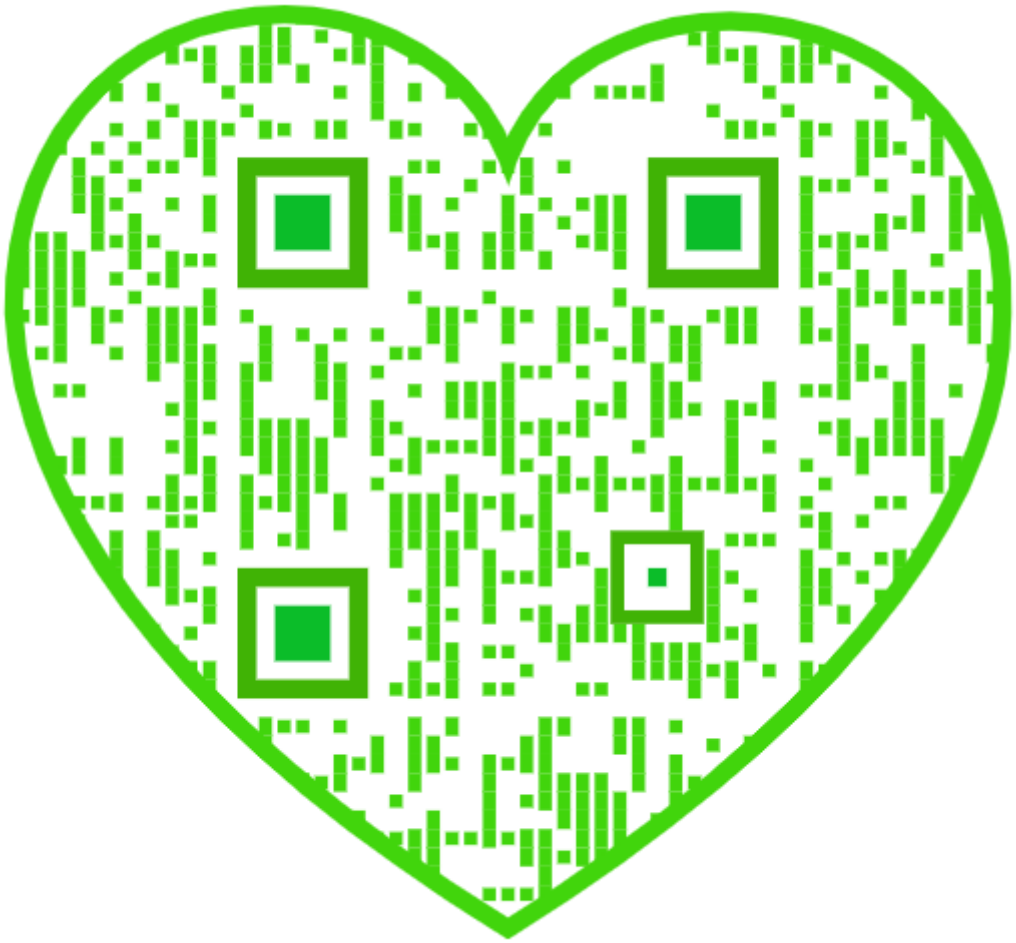
BROOM CORN CULTURE

A. G. McCALL



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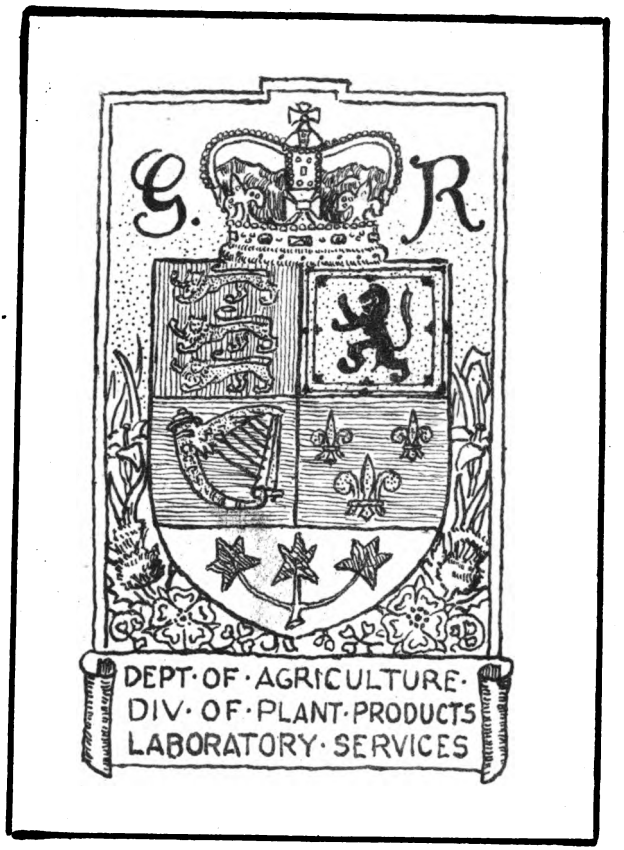

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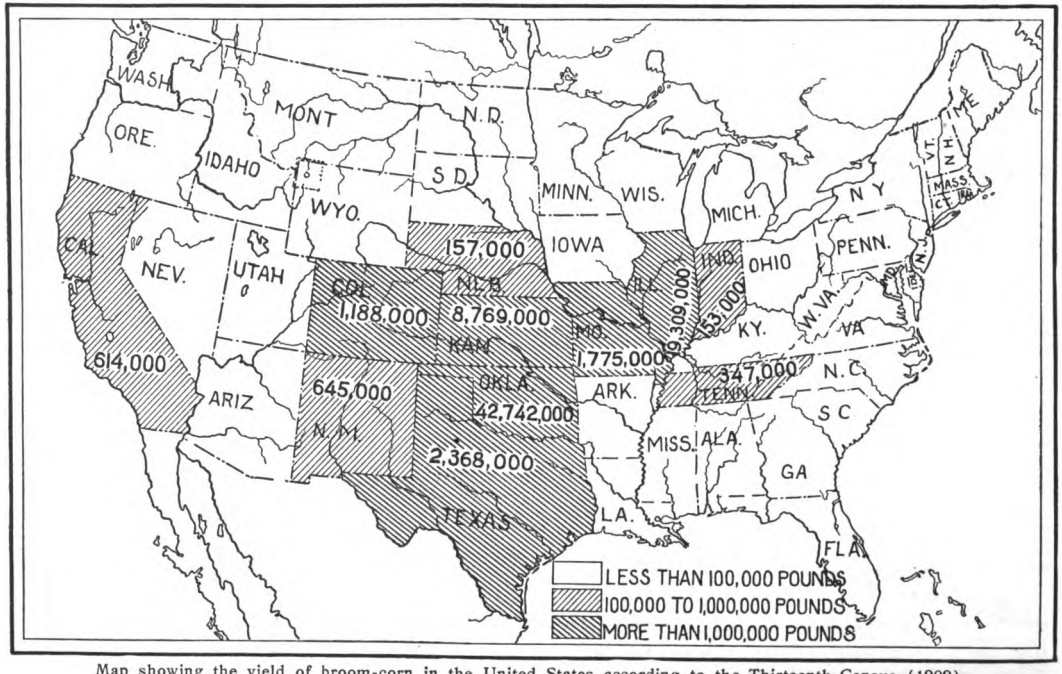

Map showing the yield of broom-corn in the United States according to the Thirteenth Census (1909).

BROOM-CORN CULTURE

By

A. G. McCALL

Professor of Agronomy in the College of Agriculture
Ohio State University

ILLUSTRATED

NEW YORK
ORANGE JUDD COMPANY
LONDON
KEGAN PAUL, TRENCH, TRÜBNER & CO., Limited
1912

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Entered at Stationers' Hall
LONDON, ENGLAND

PRINTED IN U. S. A.

SB317
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PREFACE

This little book is written in response to a demand for information concerning the culture of broom-corn.

For this information the author has drawn upon his own experience in growing the crop, and has supplemented this with the recent experience of practical growers and experiment station workers.

The writer is indebted to Mr. C. P. Hartley of the United States Department of Agriculture and to several experiment stations for photographs and other material used in the preparation of this volume.

A. G. McCALL.

Columbus, Ohio, 1912.

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CHAPTER I

PRODUCTION OF BROOM-CORN

Broom-corn is grown almost exclusively in America. In former times the Mohawk Valley in New York and the rich first bottom lands of Ohio and adjacent states supplied the market demand for this crop. But with the opening of the west the center of production has shifted, and Oklahoma has taken first rank among the states in the production of broom-corn, with an acreage more than five times as great as any other state.

According to the Thirteenth Census (1909) there are now eight states each of which produces more than 300,000 pounds of brush annually. A list of the states, with their acreage, yield and production is given in Table 1, on the following page.

At the present time the amount of broom-corn grown in New York and Ohio is quite small. From an inspection of the production table it will be seen that the yield per acre is very much larger in some states than in others. Illinois, with a planting of 38,450 acres, produced more than twice as many pounds of brush as Kansas, with a planting of 40,065 acres, and almost half as many pounds as Oklahoma, whose planting is almost six times as extensive. Of the states producing more than 300,000 pounds of brush, California has the highest yield per acre, while the lowest yield is found in New Mexico.

TABLE I. STATEMENT SHOWING THE NUMBER OF FARMS, NUMBER OF ACRES, NUMBER OF POUNDS, AND VALUE OF BROOM-CORN, BY STATES, FOR THE CROP YEAR 1909. CENSUS OF 1910.

State	Number of farms	Acres	Yield (pounds)	Value
Alabama	115	52	17,910	1,562
Arizona	1	14	6,000	400
Arkansas	294	332	106,576	8,198
California	24	1,023	614,250	32,509
Colorado	240	5,631	1,187,791	71,717
Connecticut	2	---	150	14
Delaware	21	13	4,198	492
Georgia	8	22	7,067	694
Illinois	1,854	38,452	19,309,425	1,457,172
Indiana	335	323	153,259	13,461
Iowa	49	156	75,370	6,670
Kansas	1,728	41,064	8,768,853	593,947
Kentucky	1,041	342	157,286	13,641
Louisiana	263	320	92,208	7,285
Maryland	291	19	18,599	2,006
Massachusetts	2	2	2,160	168
Michigan	9	4	2,200	233
Minnesota	13	13	10,259	788
Mississippi	43	154	60,574	5,548
Missouri	1,225	5,339	1,774,536	115,243
Nebraska	51	458	157,146	11,116
New Jersey	10	11	6,760	658
New Mexico	368	4,470	644,892	33,492
New York	10	2	1,001	97
North Carolina	128	15	6,493	549
North Dakota	3	18	7,250	725
Ohio	383	170	92,292	9,116
Oklahoma	10,151	216,350	42,741,725	2,559,235
Pennsylvania	727	108	45,582	5,253
South Carolina	3	2	650	63
South Dakota	14	64	35,400	3,408
Tennessee	2,220	1,348	347,064	27,733
Texas	531	9,448	2,368,490	140,533
Utah	1	---	200	12
Virginia	666	107	46,016	3,586
Washington	5	183	45,040	2,905
West Virginia	397	45	30,456	3,229
Wisconsin	12	28	14,830	1,026
Total	23,238	326,102	78,959,958	$5,134,434

According to the Eleventh Census there were grown in the United States in 1889, 93,425 acres of broom-corn, which produced a total of 39,557,429 pounds of brush. By 1899 the planting had been increased to

178,584 acres, with a total production of 90,947,370 pounds, or an average yield of 509 pounds per acre.

In 1909 the planting was 326,102 acres, which produced 78,959,958 pounds of brush, valued at $5,134,434.

Of the total crop produced in the United States in 1879, the states of Illinois, Kansas, Missouri, New York, Nebraska, Ohio and Iowa furnished 94 per cent.

In 1889, Illinois, Kansas, Nebraska and Missouri produced 89 per cent of the total crop.

In 1899, Illinois, Kansas, Missouri, Oklahoma, Nebraska, Texas, Iowa, California and Tennessee produced 96 per cent of the crop. Of these states California gave the highest yield, 686 pounds per acre, and Oklahoma the lowest yield, 276 pounds.

In 1909, four states, Oklahoma, Illinois, Kansas and Texas, produced 93 per cent of the entire broom-corn crop of the United States.

Table 2, on the page following, gives the acreage and production for the years 1889, 1899 and 1909, of all of the states growing more than 100 acres.

A comparison of the acreage and production for individual years reveals a great variation, accompanied by a great fluctuation in price. The high price of $150 to $200 a ton which the crop sometimes commands offers good profit to the successful grower. His success induces a large number of poorly equipped farmers to plant, with the result that a large quantity of inferior brush is thrown upon the market the following year. The poor quality of the crop is due to the inexperience of the

TABLE 2. ACREAGE AND PRODUCTION FOR THE YEARS 1889, 1899, AND 1909 OF ALL STATES AND TERRITORIES GROWING MORE THAN 100 ACRES OF BROOM-CORN.

State or Territory	Acres			Pounds		
	1909	1899	1889	1909	1899	1889
Alabama	52	152	61	17,910	56,290	25,698
Arkansas	332	879	135	106,576	304,690	52,701
California	1,023	1,669	815	614,250	1,146,000	611,975
Colorado	5,631	1,241	301	1,187,791	226,550	60,165
Florida	....	34	171	....	3,390	196,820
Illinois	38,452	95,137	34,340	19,309,425	60,665,520	15,932,502
Indiana	323	815	413	153,259	384,170	157,231
Indian Territory	....	397	....	....	147,020	....
Iowa	156	2,220	1,108	75,370	1,178,130	567,072
Kansas	41,064	34,383	30,717	8,768,853	11,813,310	10,869,434
Kentucky	342	839	195	157,286	384,550	93,063
Louisiana	320	107	24	92,208	41,120	11,420
Minnesota	13	149	80	10,259	76,960	42,090
Mississippi	154	214	41	60,574	143,750	24,776
Missouri	5,339	10,219	2,618	1,774,536	3,693,370	1,051,139
Nebraska	458	6,627	16,792	157,116	2,733,290	6,514,763
New Mexico	4,470	14	102	644,892	5,800	24,500
New York	2	356	993	1,001	201,060	450,380
Ohio	170	802	1,574	92,292	537,160	801,957
Oklahoma	216,350	12,366	59	42,741,725	3,418,490	16,550
Pennsylvania	108	221	57	45,582	114,610	36,319
South Dakota	64	239	237	35,400	100,570	117,200
Tennessee	1,343	3,444	1,439	347,064	1,015,460	409,436
Texas	9,448	3,743	596	2,368,490	1,638,150	315,741
Virginia	107	1,762	140	46,016	663,390	43,159
Washington	183	....	....	45,040	....	....
Wisconsin	28	64	157	14,830	38,850	92,468

grower and his inability to take care of the brush. The marked decline in price which follows this overproduction of low-grade material discourages many farmers, and the acreage is greatly reduced for the next season.

In 1881, Illinois grew 17,800 acres, and the average price received for the crop was $128 a ton. The year following, 43,000 acres were planted and the price declined to $80 a ton. This low price prevailed until 1891, when, with a planting of 15,800 acres,

the price went up to $117 a ton. An increased acreage the following year sent the price down to $94.

In 1909 the partial failure of the crop in Oklahoma sent the price up to more than $200 a ton and necessitated the importation of a small amount of brush from Europe.

Practically all of the broom-corn produced in the United States is made into brooms in this country. The export trade amounts to about $425,000 a year, of which a very large share is with Canada and Cuba. The shipment of broom-corn from this country has increased from $240,164 in 1906 to $424,484 in 1910.

CHAPTER II

THE BROOM-CORN PLANT

Broom-corn belongs to the great group of plants known as the grass family. Within the grass family are a large number of groups, one of which is known as the sorghums. The sorghums are divided into three groups: (1) Kafir corn, grown for forage and for grain; (2) common sweet sorghum, used for making syrup; and (3) broom-corn, the brush or seed head of which is used in the manufacture of brooms.

Broom-corn differs from the other plants of the sorghum group in having the seed borne on long straight branches, which constitute the brush from which the brooms are made.

In all probability these three different groups of sorghums have been derived, by selection, from a common ancestry. Sorghums have been cultivated in Italy for eighteen hundred years or more, and it is thought that the broom-corn type originated in that country by the continual selection of the sweet sorghum heads which bore elongated branches. The first record of this plant having been used for the manufacture of brooms is from an Italian source.

Varieties.—There are two recognized agricultural varieties of broom-corn, the dwarf and the standard.

The dwarf type produces leafy stalks 3 to 6 feet in height, with a brush 10 to 18 inches long. The head, or brush, is partially inclosed in the upper leaf sheath or boot.

The standard type grows to a height of 10 to 15 feet and produces a brush 18 to 24 inches in length, which grows out beyond the leaf sheath.

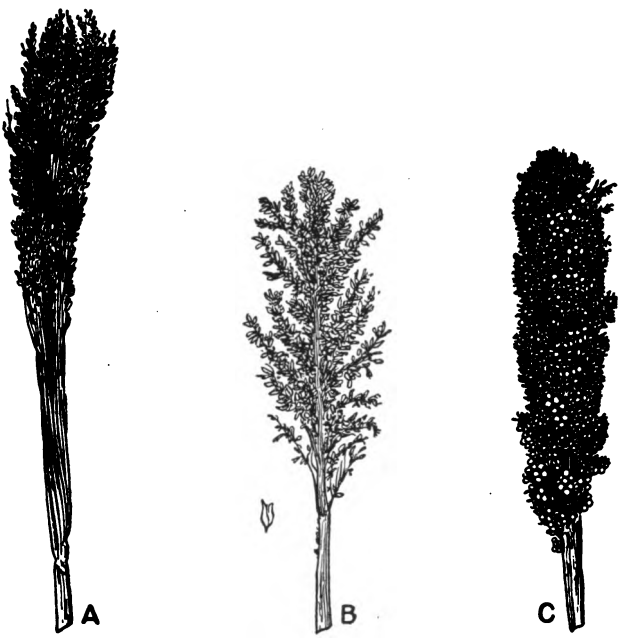

Fig. 1. Characteristic heads of sorghum. A, broom-corn; B, sweet sorghum; and C, kafir corn.

The brush of the standard type is used for making large carpet and stable brooms, while the fine brush from the dwarf corn is used largely for the manufacture of small hearth brooms and whisk brooms for clothing. For making large brooms the dwarf corn is not so desirable as the standard type, because the straws are weak and less durable, but

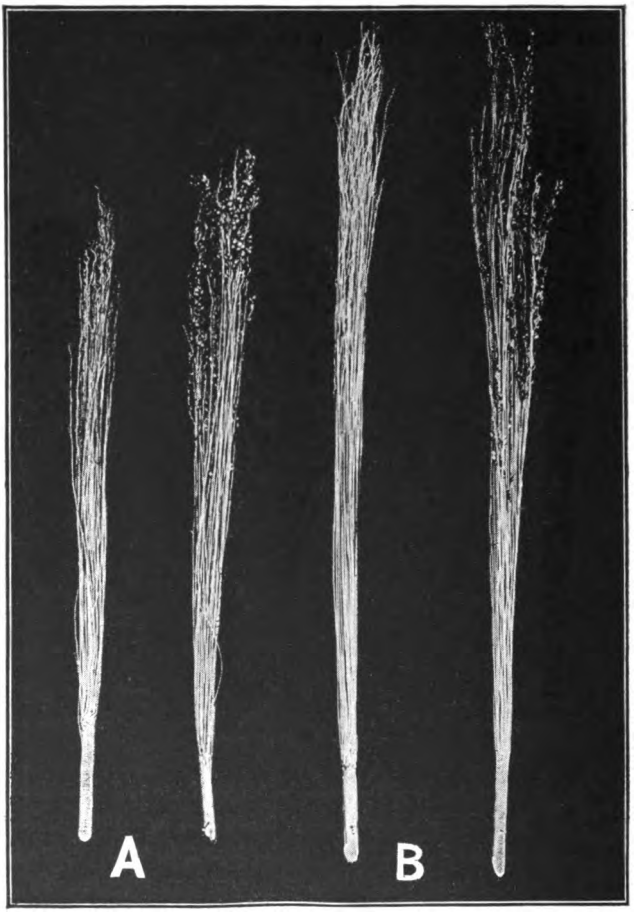

Fig. 2. Desirable seed heads of the dwarf (A) and the standard (B) types.

for whisk brooms the demand is for straw that is fine, straight, tough, elastic and of a uniform green color without red tints.

The dwarf type does not produce as heavy a yield of brush as the standard, but the former commands a very much higher price on the market.

Standard and dwarf heads exhibiting desirable and undesirable characteristics are shown in Figure 3. Dwarf heads, inclosed in the upper leaf sheath, are shown at A and B, while C represents a dwarf head of fine quality of brush. Contrasted with this is the large dwarf head D, which is weak at the attachment of the straws. The other heads shown in the drawing represent good and poor grades of standard heads.

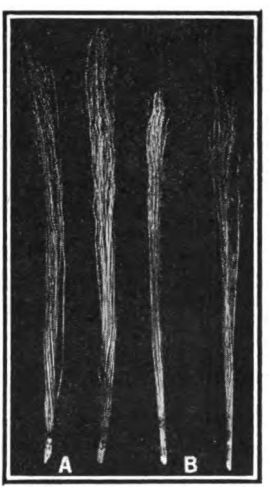

Fig. 4. Coarse imported brush (A) and good domestic heads (B). The former is used in the manufacture of coarse stable brooms.

Occasionally, when the domestic supply is not equal to the demand, a small quantity of foreign grown brush is imported. The imported material has coarse, brittle, straw, as shown at A in Figure 4. It is used in the manufacture of coarse heavy stable brooms, and to some extent it is worked into the centers of the low-grade house brooms.

Our seedsmen sell broom-corn seed under several

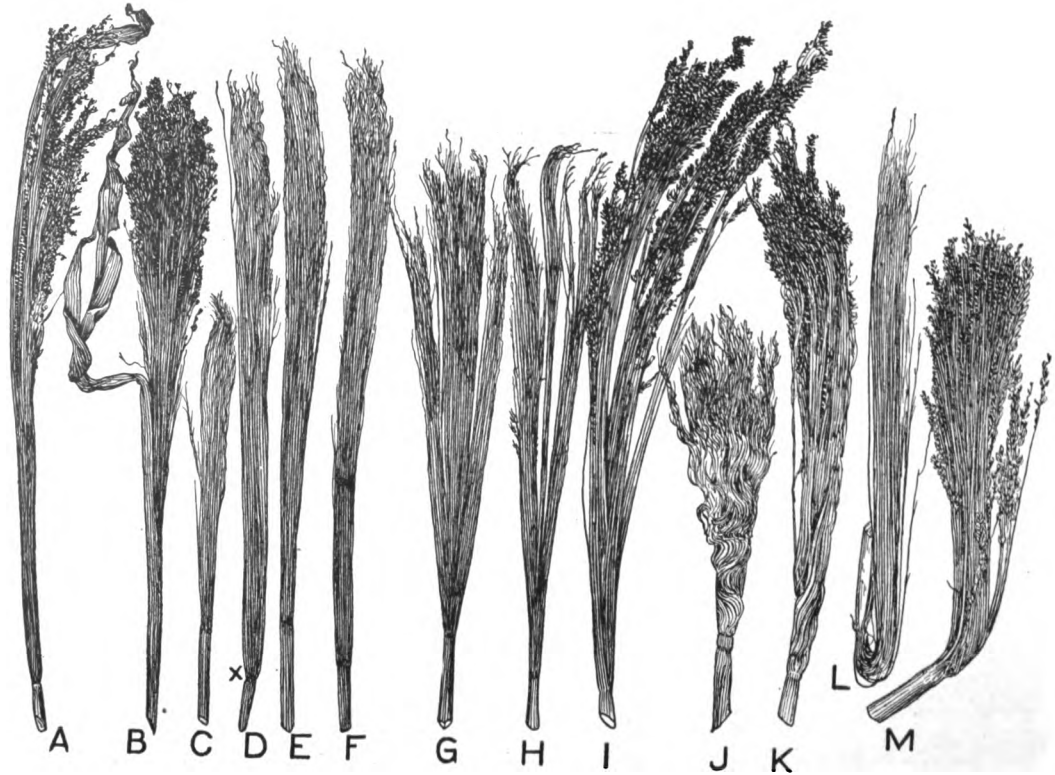

Fig. 3.- Good and poor heads of dwarf and standard broom-corn: A, poor head on account of large center; B, head inclosed in boot or leaf sheath; C, good head of dwarf for whisk brooms; D, long head of dwarf, with weakness at X- E, F and G, good heads of standard hurl; H, low-grade standard, with heavy center; I, J, K and M, worthless heads; L, a good grade of crooked head. (After Hartley.)

different varietal names, some of which are as follows: Improved Evergreen, Tennessee Evergreen, Missouri Evergreen, Imported Evergreen, California Golden, Little Dwarf, Dwarf Emerald and Mohawk. Several of our experiment stations are conducting variety tests of broom-corn, but these have not been conducted for a sufficient length of time to be of practical value. The quality of the brush from which the seed was selected and the quality of the seed itself is of more importance to the purchaser than the varietal name under which the seed is sold.

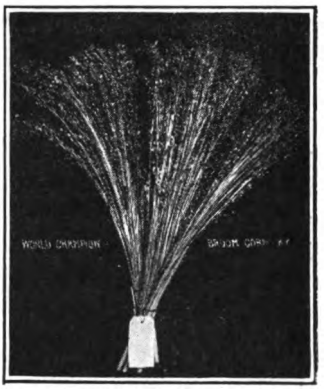

Fig. 5. A good sample of broom-corn from Kentucky, which took first place at the National Corn Exposition (1911) at Columbus, Ohio.

CHAPTER III

SOIL AND CLIMATIC CONDITIONS

A soil that will produce a good crop of corn is well suited to the production of standard broom-corn. A lighter, sandy soil is better adapted to the production of the dwarf type. The rich corn soils have a tendency to produce a coarse brush, while the light sandy loams produce, when planted to the dwarf varieties, a short, fine, tough brush which is in great demand for the manufacture of fine whisk brooms.

For the production of a good crop of long standard brush a fertile soil is required, but the rich bottom lands that are subjected to overflow should be avoided, because the weeds will give trouble during the early part of the season when the broom-corn is making slow growth. Soils that are badly infested with weeds should not be planted to this crop, because of the large amount of hand labor that will be necessary to keep the weeds in check until the plants are large enough to cultivate.

The production of high-grade broom-corn, however, is more dependent upon climatic conditions than upon the character of the soil upon which it is grown. The plant is of a subtropical origin and does best in a warm, sunny, climate where there is sufficient moisture during the early part of the season to produce a rapid, healthy growth. It is very essen-

tial, however, that dry weather prevail at harvest time, in order that the brush may be dried rapidly and in a manner that will enable it to retain its fresh green color. Localities in which frequent rains occur at the time when the brush should be harvested will be found unsuited to the production of broom-corn. Rain at the time the plants are ripening will cause some of the heads to turn red and thus materially reduce the quality of the brush. Exposure to rain after the heads are cut causes the straw to lose its fresh, green color and to take on a yellow, bleached appearance. Hence it is practically impossible to produce a crop of good quality unless dry weather prevails during the normal ripening and harvesting period.

Taking both soil and climatic conditions into consideration, it is found that the rich prairie soils of the middle West are well suited to the production of the standard type of broom-corn, and that the light, dry soils of the semiarid regions of Kansas and Oklahoma are well adapted to the production of the dwarf types.

Since such a comparatively small area is devoted to broom-corn, it would be a very easy matter to increase the acreage devoted to the crop and stay within favorable soil and climatic bounds. But since the market demand for the brush is limited, it is not probable that the area devoted to broom-corn culture will be greatly increased in the near future.

The development of the broom-corn industry should be in the direction of better cultural methods

and the production of a superior quality of brush, to meet the demands of the manufacturer for a high-grade material of uniform quality.

The Choice of Land.—Broom-corn will permit of later planting than most of the principal crops, and for this reason it is sometimes advisable to use it as a gap crop for replacing corn, oats or other cereals that have failed to make a good start.

As a rule, however, careful attention should be given to the selection of the land to be devoted to broom-corn. It is quite essential that the soil of the field should be of uniform fertility and free from weeds. A foul piece of land planted to this crop will require a great amount of labor to keep the weeds from choking the young plants, since the broom-corn makes a very slow growth for the first two or three weeks until it gets its root system out into the soil.

In localities where broom-corn is grown quite generally, it should be made to take a permanent place in the regular system of crop rotation. The grower can then afford to supply himself with drying sheds, scrapers, a baling press and other equipment necessary for the proper handling of the crop.

It is unwise to make broom-corn the principal crop, as is sometimes done in Illinois, Kansas and Oklahoma. It is much safer to devote only a part of the farm to this crop and hold the brush until the market permits of a profitable sale. If broom-corn is grown exclusively, the holding of the brush for a higher price will entail a large financial burden, and in addition to this, the work of the farm will be

very unevenly distributed throughout the year, and it will be extremely difficult to secure sufficient help to harvest the crop and get the brush properly cured.

Preparation of the Seedbed.—The plowing and the preparation of the soil for broom-corn should be practically the same as for corn. Winter or very early spring plowing is advisable in order that the land may retain the moisture derived from the early spring rains, and that the soil may be worked down thoroughly in order to sprout and destroy the weed seeds that are in the surface soil. This is quite essential because of the fact that the broom-corn plant makes very slow growth for several weeks after it comes through the soil, and unless the weed seeds have been sprouted and destroyed a great deal of extra labor will be necessary to keep the weeds down until the plants are large enough to permit of effective cultivation.

The seedbed should be worked down to a fine, mellow condition by the liberal use of the disk harrow, the roller and the smoothing harrow. Stalks, coarse manure or other trash should be removed or cut into small pieces with the disk and worked into the soil, since their presence at the surface will interfere seriously with the early cultivation of the plants. The fine, mellow seedbed is necessary in order to secure a uniform stand of plants, and to insure a prompt and early destruction of weeds.

CHAPTER IV

DATE AND METHOD OF PLANTING

In Illinois and in the other states of the middle West, broom-corn is planted from the middle of May until the middle of June and harvested in about ninety days from the date of planting. Where a very extensive acreage is grown the fields are planted at intervals of a week or ten days, in order to provide ample time for the harvesting of each field while the plants are at the proper stage of maturity.

The best date for planting will depend upon the climatic conditions and upon the season, but under no conditions should the seed be placed in the ground until the soil is warm enough to insure the prompt sprouting of the seed.

Broom-corn will not stand as early planting as corn, for if the seed is placed in a cold soil it will germinate very poorly and give an irregular stand of weak plants. The fact that it requires later planting than corn is a point in favor of the growing of broom-corn, since it permits of a more satisfactory and equitable distribution of the spring work.

Method of Planting.—In some regions it may be necessary and desirable to time the planting with reference to the weather conditions at harvest time in order to secure a dry season, during which the proper curing of the brush may be effected. In California the planting is made about one month earlier

than in Illinois, in order to have the crop ready for harvest at a time when dry weather is most likely to prevail.

If equipped with special broom-corn plates, the ordinary corn planter may be used for planting the seed. If the special plates are not available, the holes in the plates used for planting corn may be run full of melted lead and then bored out to the proper size for distributing the broom-corn seed at the proper rate.

For standard broom-corn the rows should be about 3½ feet apart and the plants in the rows approximately 3 inches apart, while for the dwarf type the rows should be 3 feet apart and the plants in the rows about 2 inches apart.

Broom-corn is sometimes planted in hills for convenience in hoeing and cultivating. In this case the hills are spaced about 16 to 18 inches apart in the rows, with five or six stalks of standard or eight to ten stalks of the dwarf type to the hill. Three or four pounds of good seed is sufficient to plant an acre. This rate of planting will apply to fertile corn soils. If the land is thin and lacking in fertility, the plants should be farther apart in the drills and a fewer number of stalks should be left in the hills.

Every effort should be made to secure an even stand, in order that the crop shall be of uniform quality, but the practice of planting a large excess of seed is to be condemned, since the grower frequently neglects to thin his plants to the proper stand. In fact, the thinning process is a very labori-

ous task, and frequently takes more time than would be required to plant the field a second time in event of a partial failure of the seed of the first planting. The best practice is to plant the exact quantity of good seed; then, if conditions are such that a good stand is not secured, the entire field can be cultivated, harrowed and planted again. On heavy clay soils the seed should be covered to a depth of one-half inch, but on light sandy loams one inch of soil over the seed will do no harm.

Care should be taken to have a sufficient amount of moisture in the surface soil at planting time to insure prompt germination. It is sometimes advisable to roll the ground after planting to bring the soil in close contact with the seed and to induce the movement of the moisture from the subsoil up into the seedbed.

Cultivation.—Cultivation must be commenced early and repeated frequently, to prevent weeds from getting the start of the slow-growing young plants. As hoeing and hand weeding are too expensive, large weeders, harrows, and very narrow-shoveled cultivators, with fenders to keep the soil off the plants, are employed until the plants attain a height of about a foot, after which they grow rapidly and will thrive with the same cultivation as does corn. Many find it advisable to harrow lengthwise with the rows with a sharp-toothed harrow just as the plants are coming up. With a wide harrow and plenty of horse-power this operation is quickly accomplished.

The plants will probably be large enough to per-

mit of the use of a regular corn cultivator in 15 to 20 days after planting if favorable weather conditions prevail.

Level culture is most satisfactory from the beginning till the crop is laid by, and will leave the field in good condition for harvesting. Cultivations should be frequent enough to keep the soil from becoming crusted and hard, for in this condition the moisture passes off most quickly, leaving the soil dry and the soluble salts or plant food at the surface and entirely out of reach of the roots of the plants. An inch or two of finely divided soil or dust serves as a thick blanket in conserving the moisture and keeping the dissolved plant food accessible to the roots. Late in the season the soil may be stirred with a one-horse cultivator by going once in a row with this implement. For this work it should be equipped with a number of small shovels. This practice is not common in the broom-corn sections, but since it gives good results in the cultivation of corn, it should be equally effective in broom-corn culture.

CHAPTER V

THE IMPORTANCE OF GOOD SEED

The matter of good seed is one of great importance to the grower of broom-corn, since the quality and uniformity of the brush is dependent upon the quality of the seed as well as upon the character of the soil. When the crop is harvested for the brush, the seed, removed by the scraper in the preparation of the crop for market, is useless for planting because of its immature condition and its low germinating power.

The farmer who is engaging in broom-corn culture in a new locality should secure seed from several sources, and plant each lot of seed in a separate patch located some distance from any other broom-corn. It is necessary that these test plots be placed some rods apart to prevent the cross fertilization of the plants during the flowering period and the consequent mixing of the different varieties. While in the blooming period the plots should be harvested, leaving in each a few choice plants to mature seed. The different lots of brush should be compared, and the superior plants growing upon the plot producing the best brush should be allowed to ripen and produce the seed for planting the following season. This will enable the grower to judge as to the adaptability of the different strains to his locality and will give him the assurance that his seed came from none but good individual plants.

If the isolated plots cannot be secured, the different strains may be tested side by side in separate rows, provided some of the original seed is saved for future planting. In this case no seed would be saved from the test plots, since it would show mixture.

Experienced growers may greatly improve the quality of the brush they are producing by exercising greater care in the selection of seed. This is particularly true in localities where farmers are growing the three different classes of sorghums, namely, kafir corn for grain and forage, sweet sorghum for syrup and the broom-corn for the brush. These different plants hybridize or cross with each other quite readily when grown in the same or in adjacent fields. Sweet sorghum crossed with broom-corn loses much of its value for syrup making, and kafir corn, when mixed with broom-corn, has its value for forage greatly impaired. When broom-corn seed becomes crossed with the other sorghums, the quality of the brush will be poor.

Fig. 6. The head to the right is sorghum, while that to the left is a good head of broom-corn. Between the two is an intermediate form, the result of a cross between sweet sorghum and broom-corn.

Figure 6 shows three heads selected from a field of sorghum being grown for forage on a farm where broom-corn is a regular crop. The head shown to the right is a black-seeded sorghum and to the left is seen a good head of broom-corn. The head in the

center is a cross between the sweet sorghum and the broom-corn and exhibits characters of color and form intermediate between the parent forms.

It is important, therefore, that the grower keep his seed pure and free from mixture with the plants belonging to the other groups of the sorghum family. Furthermore, it is important that the grower select his seed exclusively from plants producing fine, straight, tough, elastic straws, for the crop grown from seed produced by any particular plant will be much like the parent. If the seed head is coarse with a large central stem or twisted straws, as shown in Figure 7, many heads of a like kind will be found among its progeny. Of course, the most carefully selected seed will not produce all good heads, because of the influence of more remote ancestors of poor quality, but careful selection of seed from year to year will greatly reduce the number of poor individuals, provided the crossing with other varieties is prevented.

It is a common practice to allow a portion of the general crop to ripen and produce the seed for the following year. A separate seed patch will involve more labor, but it will be much more satisfactory in the end. Such a patch should be planted each year with the seed from the choicest plants of the seed plot of the previous season and should be sufficient in size to permit the grower to reject a large number of plants and yet have a sufficient number of individuals left to produce the required amount of seed. The careful breeder will often find it desirable to reject ten plants for every one which he

selects for seed. All seed that is intended for the same field should be selected from plants that have ripened at the same time, in order to avoid the annoyance of having a part of the plants ready to harvest before others have reached the proper stage of maturity. In the principal seed-producing sections the crop is harvested in September. The yield varies from 1,500 to 2,500 pounds to the acre, from which there will be a loss of about 25 per cent when the seed is recleaned. Good clean seed should weigh 45 to 55 pounds to the measured bushel. The legal weight per bushel is quite variable, ranging from 30 pounds in Oklahoma to 42 pounds in Tennessee and 57 pounds in Minnesota. Where the seed is grown commercially, it is removed from the plant by means of a power stripper, recleaned and stored in bulk; but when the grower has his own seed patch, the seed is best stored in the head. This may be done by piling the heads in a loose heap or by bunching a number of heads together and suspending them from the rafters of the attic or crib by means of a wire or a stout twine. If the heads are handled

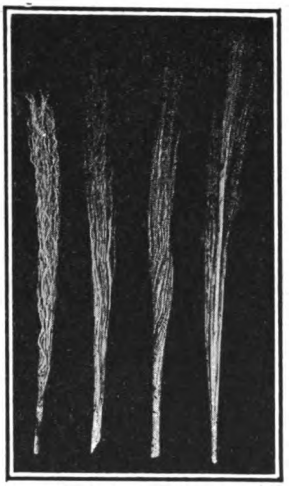

Fig. 7. Undesirable brush having large central stems and twisted straws. Seed should be selected from plants producing fine, straight straws. If seed is selected from heads like the above, many heads of a like kind will be found among the progeny.

in this way and threshed out shortly before planting time, the grower will be assured of a good quality of seed. Suspending the heads will protect the seed from rats and mice and avoid any danger from the heating and molding which might occur when the brush is stored in a heap on the floor.

CHAPTER VI

TESTING THE VITALITY OF THE SEED

No grower can afford to plant seed that has not been tested for vitality. If the seed has been well cared for and gives a germination test of 95 per cent, one bushel will be sufficient to plant 16 to 20 acres. If it can be avoided, no seed should be planted that tests below 90 per cent. The use of seed of low vitality results in an irregular stand, with the result that plants standing alone will produce a coarse brush of poor quality, while the crowded plants will be stunted and irregular in their development.

Two dinner plates and a piece of heavy flannel cloth make a convenient tester. One hundred seeds are selected at random and placed between the folds of the moistened cloth. The cloth is placed in one of the plates, and the other plate inverted over the top to prevent the cloth from drying out too rapidly. The tester is then placed where the temperature during the day will be 70 degrees to 80 degrees Fahrenheit, and will fall to 50 degrees during the night. In three or four days the seed should begin to sprout. The tester is examined at intervals and the sprouted grains are removed after having been counted and recorded. If at the end of 10 or 12 days there remain ten or more seeds that have not sprouted, the lot of seed from which the seed was taken is not fit for planting and should be rejected.

A corn germinator or a cigar box filled with sand will serve equally as well for testing the seed. Fill the box to within one inch of the top with moist sand and distribute the 100 seeds uniformly over the surface of the sand. Cover the seed to a depth of one-half inch with a layer of moist sand, keep moist, and at the end of 10 or 12 days count the number of plants growing up from the sand. The sand box method is to be preferred, since the conditions obtained are more nearly like the field than those secured by the use of the cloth and the plates.

CHAPTER VII

ENEMIES OF BROOM-CORN

Weeds are very troublesome in broom-corn culture on account of the slow early growth of the plants. For this reason the crop should be planted on clean ground if possible, and every precaution should be taken to keep the weeds in check until the plants are several inches high.

Broom-corn is sometimes attacked by a smut *(Sphacelotheca sorghi)* which does great damage by filling the seed heads with a mass of black spores. This injures the brush as well as destroys the seed. Like the smut of wheat this disease is transmitted through the seed and may be controlled by the use of formalin or by the hot water treatment.

For the formalin treatment mix four ounces or one-fourth of a pint of formalin (40 per cent) with 10 gallons of water. This will make a sufficient quantity of the solution to treat 10 or 12 bushels of seed.

Place seed to be treated on clean-swept, tight floor in piles of convenient size to be stirred throughout.

Sprinkle the formalin solution from sprinkling can or nozzle upon the pile, stirring to bottom of pile, until all possible is absorbed. After a few minutes' interval repeat the operations of sprinkling and stirring; these are again repeated until at least three quarts of solution per bushel of grain has been absorbed. One gallon per bushel is not too much.

The pile is then covered with cloth or canvas for about two hours; the covering is then removed and the grain stirred at intervals by shoveling over to dry it. It is then ready to plant at any time.

In handling treated grain do not get it again smutted. The shovel, the drill, the grain bags and any other portions of floor used should be sterilized by use of the formalin solution. The bags may be soaked in it for half an hour and the others treated by sprinkling.

If preferred, the bags of grain may be dipped in the formalin solution contained in a suitable vessel; after thorough immersing the bags should be left in the formalin for 10 minutes, then withdrawn, the grain allowed to stand 2 hours in the bags and then spread to dry on a sterile surface.

A less convenient method, but just as effective to kill smut, is to dip the bags of grain for 10 minutes in hot water at a temperature of 133 degrees Fahrenheit, then dry on sterilized surface.

The chinch bug and the plant louse are the principal insect enemies of broom-corn. Crop rotation and the cleaning up and burning of all rubbish in the fields and fence rows will usually hold these enemies in check.

CHAPTER VIII

HARVESTING BROOM-CORN

Time to Harvest.—To secure brush of high quality and good green color the plants should be harvested while in bloom and during the period when the anthers are falling. When cut at this stage of maturity practically no seed is secured, so it becomes necessary to leave a sufficient number of plants in the field to ripen for seed, or to grow a separate seed patch in which the heads are allowed to come to full maturity. The latter method of seed production is to be preferred, since the seed patch gives a better opportunity to exercise care in the selection of good seed plants.

In the states where broom-corn is grown extensively the crop will be ready to harvest at a time when it will not seriously interfere with the other work; that is, just after the wheat and oats are out of the way and before the corn is ready to harvest. Where large areas are devoted to broom-corn a very large force of men is necessary to get the crop harvested while it is at the proper stage of maturity. However, if several plantings are made at intervals of ten days, the fields will not blossom at the same time and the plants may be harvested at the proper time with the minimum number of extra men.

In California and in a few other sections the seeds are allowed to ripen before the brush is harvested.

Fig. 8. Tabling broom-corn in advance of the cutters.

By this means about one ton of seed to the acre may be secured, but the quality of the brush is such that it rarely brings more than half the market price of good green brush which has been harvested at the early bloom stage. The seed secured in this manner is used as feed for hogs and poultry and is sometimes ground into a fine meal and used as a breadstuff.

The practice of growing broom-corn for grain production is of doubtful value, since a much better crop can be secured by seeding the land to kafir corn, a crop which has been improved and developed for seed production.

The harvesting of broom-corn comprises three operations: (1) cutting or pulling; (2) threshing; and (3) baling.

The cost of bringing the broom-corn up to the harvest period is about the same as the cost of producing a crop of corn, but experienced growers claim that the former crop requires $3 to $4 extra expense an acre for the harvesting. After the bloom stage is reached the quality of the brush deteriorates rapidly, hence it is necessary to employ a large force of men in order to get the crop all harvested at the proper stage of development.

Cutting or Pulling.—In Oklahoma and in other localities where the dwarf type of broom-corn is grown it is more convenient to pull the heads from the inclosing sheath than to cut the head off with a knife and then remove the sheath which incloses the lower part of the head. If the seed is selected carefully from plants ripening at the same time, a

Fig. 9. The tabled corn ready for cutting.

crop may be secured which will ripen so evenly that the entire field may be harvested at the same time by pulling the brush and loading it into the wagons directly. Unless precaution is taken to secure a uniform stand of plants that will ripen evenly, it will be necessary to go through the field two or three times, each time pulling the heads that have reached the proper stage of development. The heads should be placed in piles on the ground and shaded by a covering of stalks and blades.

Because of the partially inclosed head of the dwarf varieties they are easily injured by rain at this period. The sheath around the head holds moisture and causes the brush to turn red, which very materially reduces its market value. The greater height of the standard type makes it necessary to bring the heads down to a convenient height before they are harvested. This is accomplished by a process called "tabling." In the harvesting of standard broom-corn three men can usually work together to good advantage, since one man can table as fast as two men can cut. One man walking backward between the rows in advance of the cutters, bends down a few stalks first from one row and then from the other, in such a manner as to form a self-supporting table of a convenient height, as shown in Figure 8. Three men working together in this way can cut and table about two acres per day. Rapid cutting is an art that is acquired only by long practice. The operator passes down between two tables and with a small sharp knife cuts off the heads, at a point six to eight inches below the attachment of the

Fig. 10. The brush cut and laid on the table to the left, ready to be loaded as the wagon is driven over the empty table to the right.

straws. When the upper leaf sheath surrounds the shank it is important that the knife cut through a sufficient distance to sever the head but leave the sheath partially attached, so that it will be left behind when the head is removed. A leather stall is worn on the right forefinger, so that by grasping the stalk between the finger and the knifeblade the head may be severed by a pressure of the thumb on the back of the knife blade. Not less than six inches of stem should be left below the attachment of the straws, but if more than eight inches of shank is left the value of the brush is decreased.

As the brush is cut it is laid in small piles on alternate tables. The brush is so placed as to be within easy reach from either side as a wagon is driven over the empty table between.

Figure 9 shows the tabled broom-corn ready for the cutters, and Figure 10 shows the cut brush piled on the table and ready to be loaded as the wagon is driven over the empty table to the right in the photograph.

Hauling.—Since the quality of the brush is injured by rain, it is essential that the cut brush should be hauled to the scraper, seeded and put in curing sheds as soon as possible. In some sections the brush is cured out of doors, but this method produces a bleached head of very poor quality and one that will not command the full market price.

Where broom-corn is grown on a limited scale an ordinary handy wagon may be used to haul the brush, but where the crop is grown on an extensive scale a dump wagon (Figure 11) is usually em-

ployed. As the wagon is driven over the empty table a man on either side loads on the piles of brush from the adjacent tables. The seed heads are piled on the rack in a double row with the butts lapping at the middle in order to hold the piles in place. By means of the dumping arrangement shown in the cut, the work of unloading is accomplished very quickly. After dropping a lever to the ground the

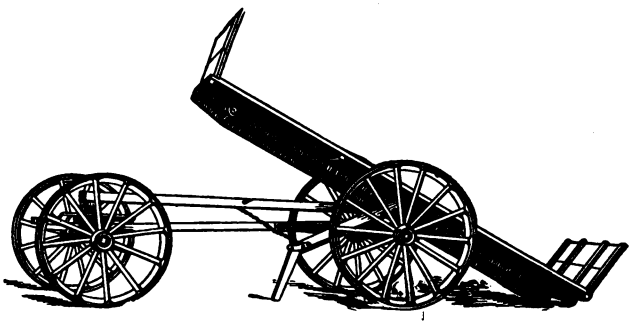

Fig. 11. Dump wagon for hauling the brush from the field.

wagon is pulled forward until the bed is shoved back and tilted so that the rear end rests on the ground. The end gate is now removed and a second forward movement of the wagon allows the brush to slip off onto the ground in the same order as it was piled on the wagon.

Sorting.—During harvest a number of plants will be found bearing heads with coarse thick centers or with brush so snarly as to be of no value. These plants should be discarded and left in the field uncut. In addition to these useless plants there will always

be found a small percentage of crooked brush which must be sorted out before the crop is marketed.

The amount of crooked brush is greatly increased if the harvesting is delayed until the seeds are well formed, since the weight of the seed may become sufficient to cause the straws to bend over just above the attachment to the stem, as shown at L, Figure 3. The same result may be produced by wet weather just before harvest time. The weight of water which clings to the heads may be sufficient to bend the straw downward.

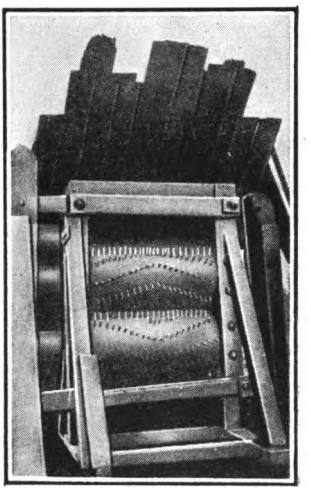

Fig. 12. Small power scraper for removing seeds from the brush.

In regions where the seed is allowed to ripen the plants are broken over before the seed is formed, so that the heads may hang pendent and produce a straight brush as well as a crop of seed.

The separation of the crooked brush from the straight heads can be accomplished most easily while the heads are in small piles in the field, where it is easy to distinguish the inferior material. The two grades resulting from this sorting should be handled and marketed separately, since a few crooked heads will lower the value of the entire bale. The crooked material will sell for about half

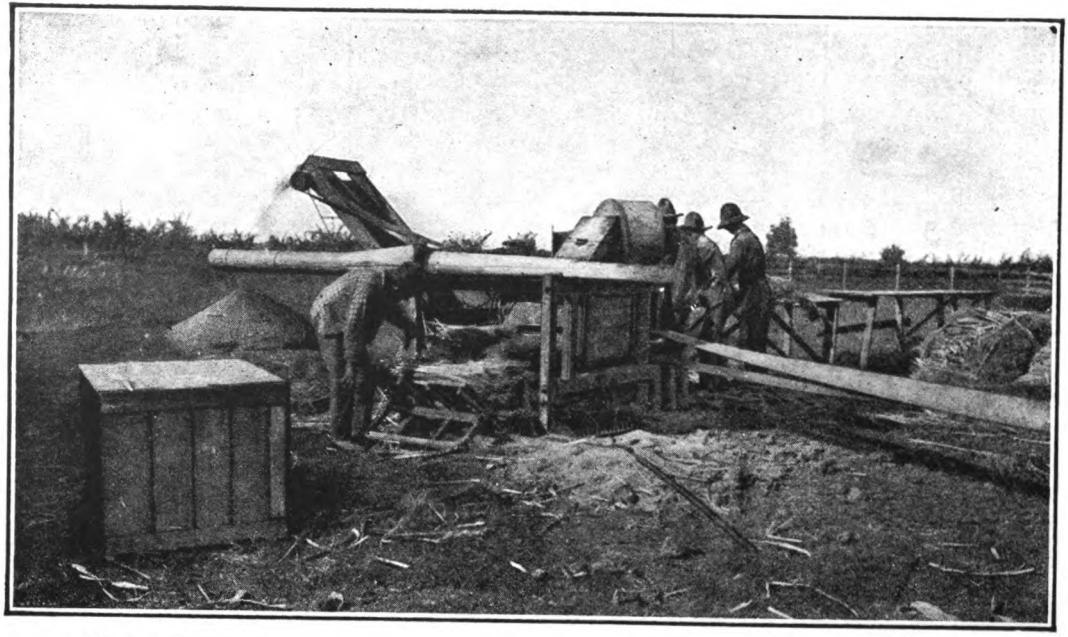

Fig. 13. Threshing broom-corn with a large power scraper. Threshed brush coming from the machine.

as much as the straight heads, and is much more difficult to bale; hence it is quite desirable that the crop should contain a minimum amount of crooked heads. Careful seed selection and prompt harvesting at the bloom stage will have a tendency to reduce the number of undesirable heads.

Scraping or Threshing.—Before the broom-corn can be baled and marketed the seed must be removed from the brush. This is accomplished by bringing the seed heads in contact with a revolving cylinder the surface of which is set with spikes or long teeth, as shown in Figure 12. If the acreage is limited this small power machine or a hand scraper will be sufficient to thresh the crop, but where broom-corn is grown extensively a large power outfit (Figure 13) is required. A thresher of this kind costs about $200 and has a daily capacity of 30 to 40 acres if 15 to 20 men are provided to handle the material. In this process the heads do not pass between the revolving cylinders, as in the case of a grain thresher. The brush is held firmly by a toothed belt which brings the seed heads into contact with the cylinders in such a manner as to thoroughly remove the seed. After passing the cylinder the brush is deposited on a platform at the side opposite to the point of entrance. The seed is collected at the bottom of the machine and removed by a conveyer situated at the end of the machine opposite the cylinders.

Curing and Bulking.—From the thresher the brush is taken to drying sheds, where it should be allowed to cure for three or four weeks before it is baled.

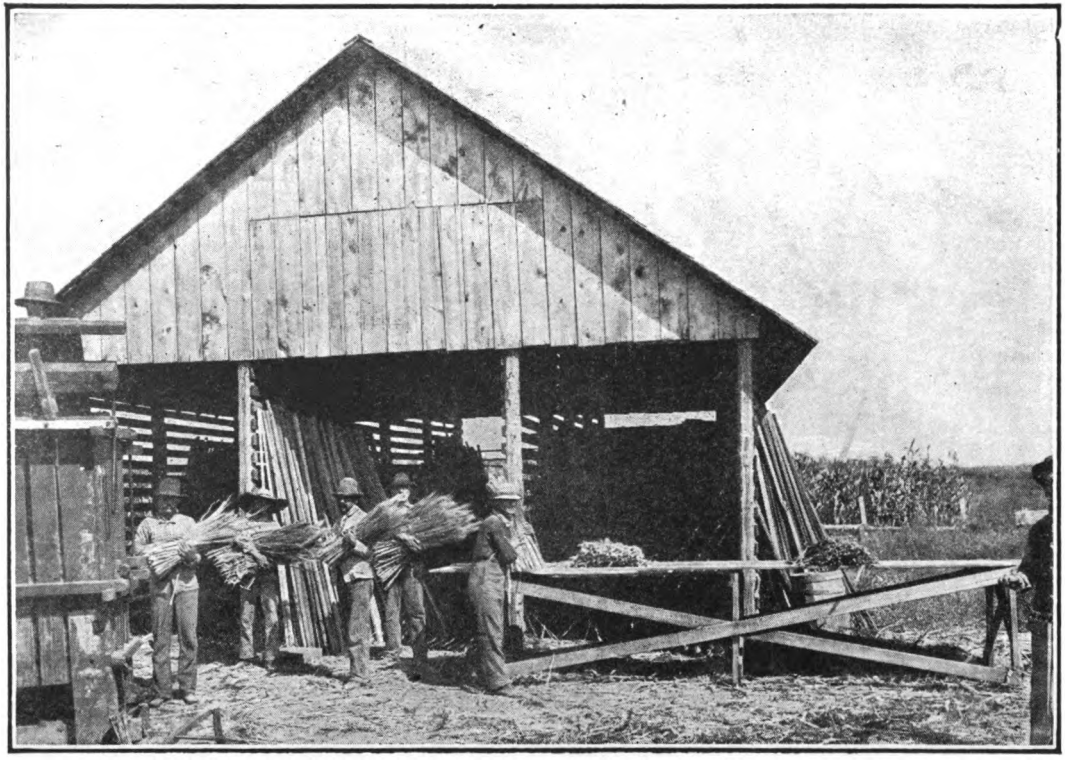

Fig. 14. Curing shed for broom-corn. Butting the brush and carrying it to the baler.

It is essential that the curing should proceed rapidly, but exposure to strong light will destroy the fresh color which is demanded by the manufacturer. Brush that has been long exposed to the weather or cured in the field is very inferior in quality and does not command a good price on the market.

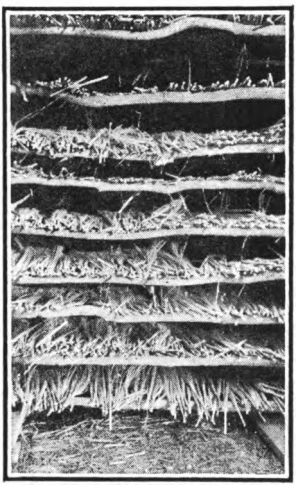

Fig. 15. Interior of a shed in which light poles are used for shelves. The brush is piled in thin layers to permit a free circulation of air.

In the important broom-corn sections special curing sheds are provided. The building shown in Figure 14 is typical of the Illinois region and exhibits the essential features of a good shed, namely, a tight roof with wide projecting eaves and ample provision for the free circulation of air.

To care for 20 acres of broom-corn will require a shed about 24 feet long, 16 feet wide and 10 feet high to the eaves. A second 20 acres may be cured in this shed the same season if the planting is so arranged as to have the second field ready for harvest three or four weeks later than the first planting, since the first crop will be ready to bulk down by the time the second planting has reached the harvest stage.

During the curing season these sheds are used

Fig. 16. Baling the crop. The crooked and the straight brush should be placed in separate bales.

exclusively for broom-corn, but during the remainder of the year they may be used for hay barns or for the storage of machinery.

A common method of construction is to support the roof by means of uprights placed eight feet apart, and nail to these uprights narrow strips 4 inches apart and running lengthwise of the shed. A large number of slats or strips 2 inches wide and 8 feet long are provided for shelves upon which the brush is to rest. But these are not put in place until the shed is being filled. Beginning near the ground the first shelf is formed by placing two of these strips across the section parallel to each other and about 1 foot apart, with their ends supported by the lowest longitudinal strips. The brush is then spread evenly over this shelf to the depth of 3 inches, and then a second shelf is constructed in the same manner as the first. This process is repeated until the entire shed is filled with shelves 4 inches apart and each carrying a layer of brush three inches deep. It is necessary to keep the layers thin, in order to secure a good air circulation and thus facilitate the curing and drying of the brush.

Figure 15 shows the interior of an Ohio shed in which the shelves have been constructed of light poles instead of sawed strips.

If warm, dry, weather prevails the brush will be ready to bulk down in three or four weeks. It should not be taken from the shelves, however, until the stems show no signs of moisture when squeezed or twisted. If left on the slats in the curing shed too

long, the quality of the brush will be injured by bleaching.

In the bulking process the brush is removed from the shelves and piled in straight, compact ricks, from which it is taken direct to the baler as soon as it is thoroughly dry.

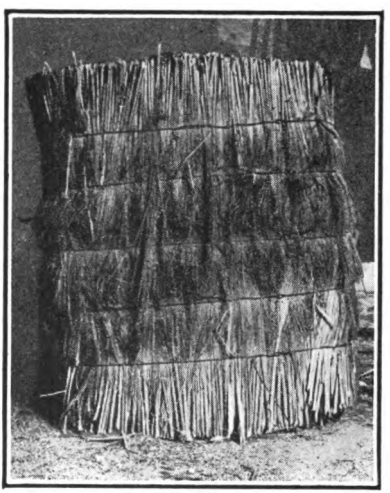

Fig. 17. A well-constructed bale of broom-corn as it was received at the factory.

Baling.—Practically all of the broom-corn grown in the United States is marketed in the bale. In the process of baling the brush is compressed into tight packages and bound with wire. This is usually accomplished by means of a horse or hand-power machine which requires a force of six or eight men for its operation at full capacity.

The broom-corn is taken up from the bulk by small arm loads and after butting the brush (Figure 14) it is passed to the man in the baler (Figure 16), who builds up a double tier with the butt ends of the brush to the outside and the tops lapping at the center. After the pressure has been applied, heavy No. 9 wire is passed around the bale at five different points. It is necessary to use large wire to prevent the brush from being cut. The bale as it comes from the press is usually about 45 inches in length and width by 24 inches in thickness, and weighs 300 to 400 pounds, with an average of about 340 pounds. Figure 17 shows the appearance of a properly constructed bale.

With a crew of seven or eight men a good horse-power baler will put up 10 tons per day. Manufacturers are becoming more exacting in their requirements that the broom-corn which they buy shall have been thoroughly seeded and properly baled. An average-sized bale will make about 15 dozen brooms.

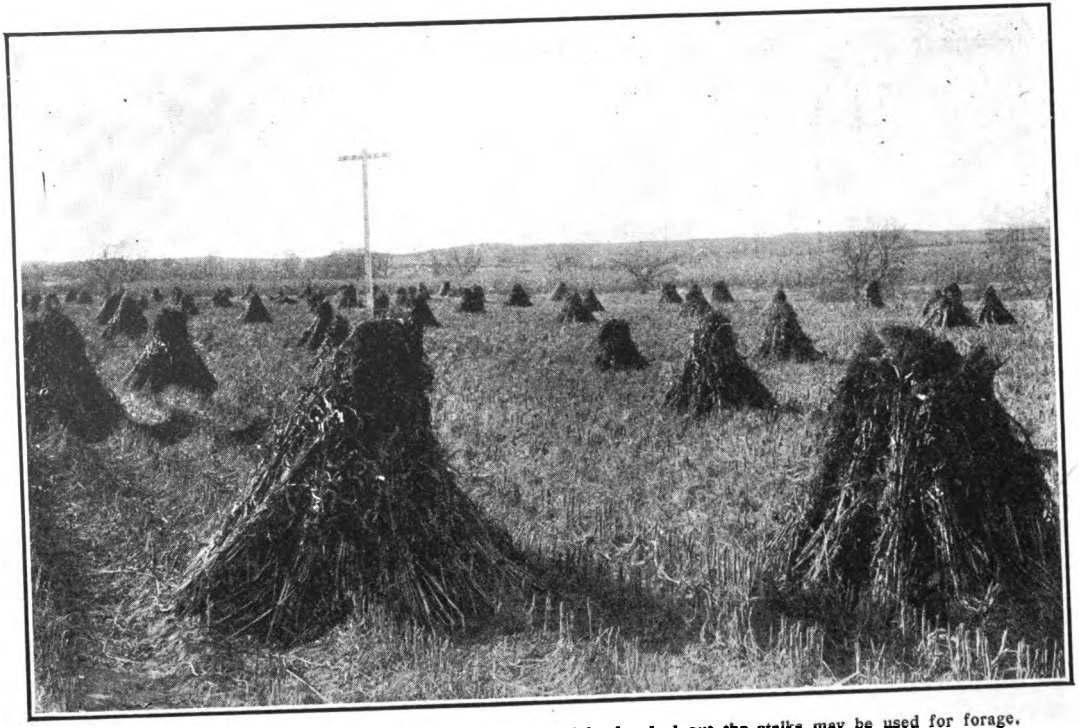

Fig. 18. Dwarf broom-corn in the shock. After the seed is threshed out the stalks may be used for forage.

CHAPTER IX

BROOM-CORN BY-PRODUCTS

In sections where the plants are allowed to ripen the broom-corn seed is used for feed, but in the important broom-corn producing sections the brush is harvested during the blossom stage, and very little seed is secured.

Feeding tests with the fodder of standard broom-corn has shown that the stalks are woody and unpalatable, and that they are of little value for feeding purposes. But if cut immediately after the brush is harvested the dwarf varieties produce a fodder almost equal in feeding value to corn stover. Figure 18 shows a field of dwarf broom-corn which has been cut and shocked. After threshing the stalks may be used for forage.

In 1909 the United States Department of Agriculture began a series of tests to determine the value of broom-corn stalks for the manufacture of paper. Since broom-corn has been selected for the production of a larger quantity and a better quality of brush, it is natural that the production of fiber in one part should be correlated with a higher quality of fiber in the whole plant. As a result of these experiments it was found that the broom-corn stalk is suitable, so far as quality and yield of pulp is concerned, for immediate use in paper making. It reduces to pulp rapidly and with a small consump-

tion of steam and chemicals, the time being three to four hours as compared with eight to twelve hours for wood pulp.

The most serious disadvantage is the limited production of the raw material, the total of which does not amount to more than 1,000 tons for the entire United States.

The stalks when extracted for an hour under steam pressure, yield a quantity of soluble solids which contain practically all of the food value of the raw material. These tests indicate that if they can be secured in sufficiently large quantities, the broom-corn stalks can be pulped at a profit without taking into consideration the value of the food extract.

CHAPTER X

THE MANUFACTURE OF BROOMS

In former years many farmers raised a small quantity of broom-corn for the purpose of supplying their household with brooms. The crop was harvested, cured and made into brooms by the farmer and the members of his family. In some cases the entire manufacturing process was completed without the aid of machinery, while in other cases the handling of the crop was facilitated by the use of very simple homemade machines which were operated by hand.

According to the Twelfth Census, there are in the United States 1,526 broom and brush manufacturing establishments, with a capital of $9,616,000. Among the states, Illinois takes the lead with 156 factories, representing a total capital of $500,000.

At the present time the manufacture of brooms in the home has been almost entirely superseded by the factory method. And hand machines have been supplanted by power machines. With the hand machines one man can make seven or eight dozen brooms per day, while with power machines the process is divided between several operators and the output very much increased. Some of the larger manufacturing establishments turn out more than a thousand dozen finished brooms per day.

Homemade Brooms.—Several years ago a writer

for the *American Agriculturist* gave the following directions for making brooms by hand: "When ready to go to work, take as much as will be needed for the number of brooms to be made, and set the stalk portions in water up to the brush, and leave them to soak an hour or two. When softened, gather in the hands enough for a broom, with the largest and best stalks on the outside in regular order. The good appearance of the broom when finished will depend upon the evenness of the brush and proper arrangement of the outside layers. Next, fasten a strong small cord to the ceiling, with a loop for the foot in the lower end, or tie a stick to the cord as a sort of treadle upon which to place the foot. Wind this cord two or three times around the brush. Grasp the brush firmly in both hands and roll it around several times, increasing the pressure with the foot. Instead of the foot, some use a lever upon the lower end of the cord, one end of the lever being placed under the work-bench, and the other held by a boy, who can give the required pressure. The next operation is to wind on a strong twine for a space of 1½ or 2 inches. This is best done by rolling the pressing cord close up next to the brush, wind the twine on, and roll off the cord towards the end, following it with the twine. To make a neat knot at the end, double one end of the twine and lay it along the outside of the stalks, letting the loose end lie out at the left. When the twine is all on, slip the right end through the loop, and draw the left end so as to bring the loop in under the coil of twine; then cut off the two ends close in to the coil. No

knot will now be visible, as the loop is out of sight, and the ends are securely fastened.

"If a flat broom is to be made, which is usually the desirable form, press the brush part between two narrow boards fastened near together at one end with a piece of strong leather nailed on very securely. The other end of the boards may be held

Fig. 19. Tread-power machine for the manufacture of brooms by hand.

together with a string. Instead of these boards, the brush may be put between two short boards, and screwed into a vise. The sewing is the next step. For this, a large needle of iron or steel will be required, or one of strong hard wood will answer, it should be six to eight inches in length. At the point where you wish to fasten the brush portion, say three or four inches below the winding cord, wind a

twine once, or better twice around, and tie it firmly, leaving enough of one end to sew with. Now sew through and through the brush, letting the twine at each stitch pass around the portion you have tied on, Point the needle forward in making each stitch so as to have it come out on the opposite side a little further along each time. A second twine may be tied around, and a second sewing may then be made

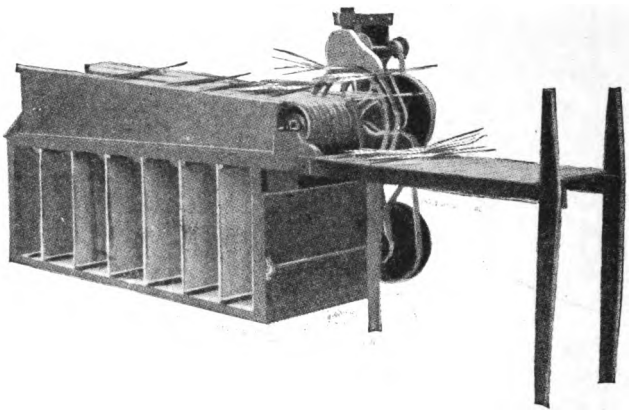

Fig. 20. Broom-corn sizer for assorting the brush according to length.

further towards the lower end. Three sewings are sometimes made. Two will generally be enough, except where the brush is very long. The broom is now ready for its handle. To put this in place, sharpen the lower end of the handle, and drive it exactly in the center of the neck of the broom, and fasten it with two small nails upon opposite sides, and the broom is complete. The lower ends of the brush may need clipping a little to make them even.

With a little practice a very neat broom may thus be made. They may be made still more tasteful, though not stronger nor more durable, by using wire instead of twine, and by paring down the stalks, so as to make a smaller, neater shank."

A slightly different method is described by another writer to the same paper. He says: "Put the butt-ends of the brush in warm water to soak awhile. When sufficiently softened, tack one end of a strong twine to the broom handle, about three inches from its lower end. Fasten the other end of the string, which is about two feet long, to a small round stick upon which you step with *both* feet. Lay on the brush, one stalk at a time, and give the handle a turn sufficient to hold each new stalk firmly. Continue putting on and winding, until three layers have been secured, pulling upward as the handle is turned to tighten the string. Now commence another row nearer the lower end of the handle, and proceed as before, finishing the third course or tier with the longest and finest brush. Wind the cord around snugly a few times after the brush is all on, and fasten the end with a carpet tack. To make a broad or flat broom, more of the brush may be put upon two opposite sides than upon the other portions. Then tie the two ends of a string the right length, slip it over the handle, and to a suitable place upon the broom, and sew. You now have as neat a broom as you can buy, and stronger than most of those in the market. With a little practice they can be made very quickly. Wire can be used instead of twine."

Factory-Made Brooms.—At the present time practically all of the broom-corn grown in the United States is manufactured into brooms in large factories which are equipped with machines for handling the crop in an economical manner.

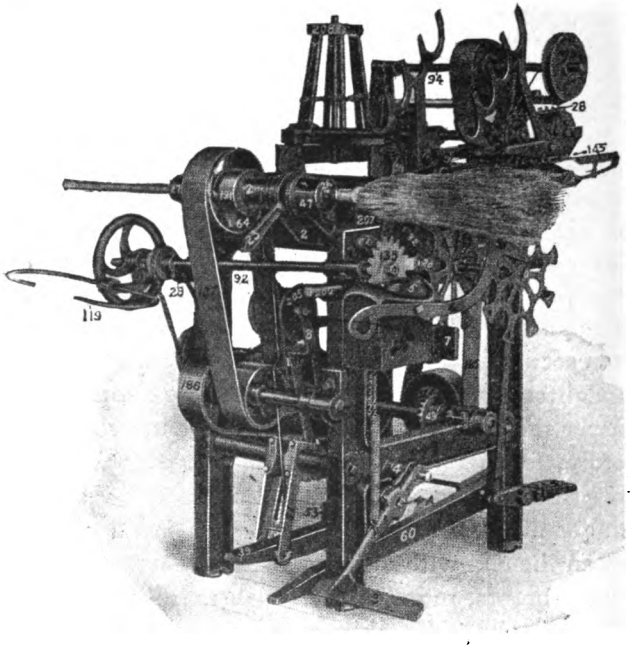

Fig. 21. Broom-winding machine used in large factories.

In some of the small factories the machines are operated by hand, but the larger establishments make use of power machines for all of the processes of converting the raw material into finished brooms or whisks. Figure 19 shows a tread-power machine

by which one man can make from six to eight dozen brooms per day. It consists of a table with a projecting wing under which is a revolving hollow shaft, which serves as a socket (*a*) to receive the broom handle. The socket is revolved by means of a belt from the treadle (*b*).

The broom-handle is placed in this socket, with seven or eight inches of the butt exposed, and held fast by a setscrew. A tack is driven part way in, about an inch and a half from the end of the handle, and the wire wound around it; the tack is then driven down, and the wire thus fastened. The handle is revolved two or three times to give the wire a firm hold around it before any brush is put on. The wire is wound on a reel, shown in the engraving at *c*, passes around three pulleys, by which the requisite tension is procured, and then passes to the broom handle. When the wire is properly fastened, the operator takes a handful of coarse, rough brush, and holds the stalks beneath the wire as the handle turns, spreading them smoothly, and pounding them down closely with a flat pounder, made something like a common potato masher, which is used in kitchens, but is flat or oval instead of round. This brush is the filling, and about three small handfuls are needed for each broom. The wire should be wound around the filling three or four times, and as the brush revolves the stalks are smoothed off with a sharp knife just above the last turn of the wire. The wire is then slipped off the brush on to the handle, and wound around it once about half an inch above the smoothed end of the stalks. Then a hand-

ful of the sorted brush, suitable for the kind of broom to be made, is taken in the left hand, and with the knife the stalks are cut half through with a sloping cut half an inch above the straw, and the

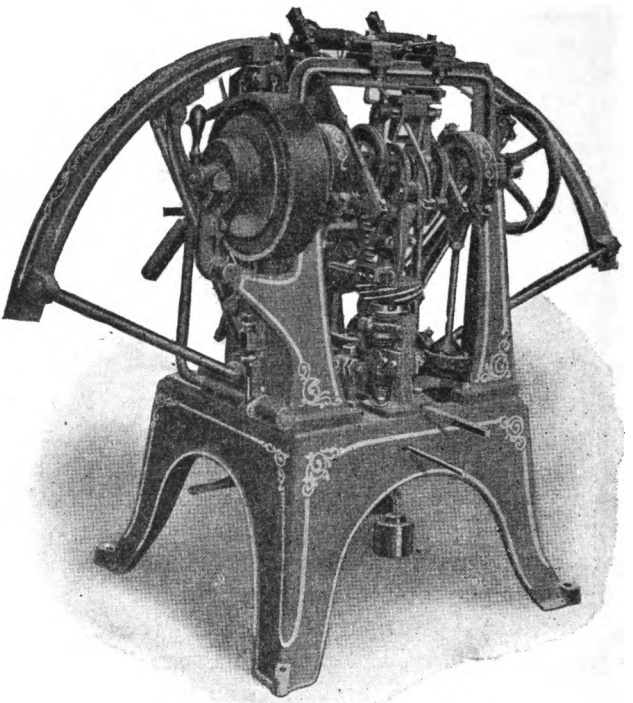

Fig. 22. **Broom stitcher. Capacity, four to seven dozen brooms per hour.**

half of the stalk split off. The stalks are then placed beneath the wire so that it may be wound exactly over where they were cut. The treadle is turned until the stalks are all bound on, when another handful

is taken and treated precisely the same way, and then finally another handful. Each handful consists of six or eight stalks, and they should be placed smoothly and close together under the wire. The wire is bound evenly around the stalks until there is sufficient to hold the broom firmly together, when it is fastened with a tack as at the commencement. The pounder is constantly used to pack the brush.

The broom is now round in form, and must be placed between a pair of clamps and securely stitched. When the stitching has been completed the broom is removed from the clamps and trimmed by means of a clipping machine, shown in Figure 23.

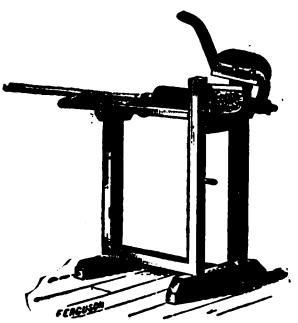

Fig. 23. Clipper for trimming the ends of the brooms.

In the large factories the broom-corn is taken directly from the bale and fed into a sizer similar to the one shown in Figure 20. This machine cuts off the extra lengths of stalks and distributes each size of corn into separate compartments, sorting it into seven lengths, from eleven inches upward. One-eighth horsepower is required to operate a machine which will size from 1,000 to 1,500 pounds of brush a day. A broom-winding machine such as used in large factories is shown in Figure 21. A good broom maker, with the aid of a boy, can wind five hundred brooms per day with this equipment.

Figure 22 is the rear view of a power stitcher which has a capacity of from four to seven dozen brooms per hour, according to the skill of the operator and the style and the size of the broom being sewed. All sizes and shapes of brooms may be stitched on this machine by simply changing the shaping jaws which clamp the broom in position.

In addition to these machines a factory should have a hurl cutter and sizer, broom clippers (Figure 23), and a power scraper for removing the seed from the brush that has been carelessly handled before shipment. The power scraper shown in Figure 24 is provided with a fan for carrying away the seeds and dust. The fan should be connected with a chute leading outside of the room in which the scraper is being operated.

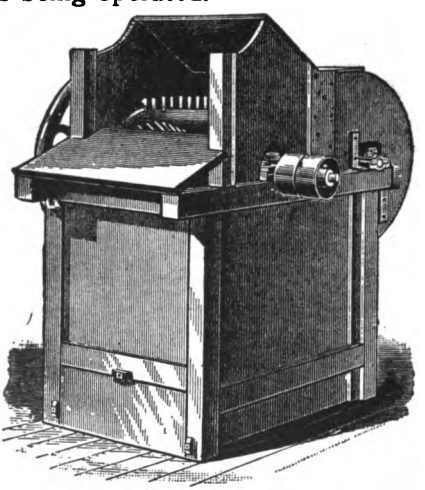

Fig. 24. Small power scraper with fan for carrying away the seeds and dust.

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